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## DISEASES OF CUCURBITS AND THEIR MANAGEMENT

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### Abstract

Managing diseases is a very important component of production for melons, cucumbers, squashes, pumpkins, and other cucurbit crops. The already extensive list of more than 200 cucurbit diseases has expanded recently to include cucurbit yellow vine disease, Acremonium collapse, Rhizopycnis root rot, bacterial blight, cucumber root rot, *Cucurbit yellow stunting disorder virus*, *Cucurbit leaf crumple virus*, and Cucurbit leaf curl virus. Additionally, diseases that have recently increased in importance include the vine declines, bacterial wilt, powdery mildew on watermelon, Phytophthora blight, diseases caused by *Fusarium* species, and several diseases caused by viruses. Management practices effective for various diseases include rotation, deep plowing, fumigation, solarization, pathogen-free seed, treated seed, host plant resistance, fungicides, sanitation, manipulating the greenhouse environment, improving soil drainage, adjusting soil pH, drip irrigation, plastic mulch or other soil barrier, planting when soil is not too cold, controlling weeds and insects, avoiding moving pathogens on equipment or hands, roguing infected plants, minimizing injury during harvest, chlorine spray or hot water treatment after harvest, culling symptomatic fruit before storage, and providing proper storage conditions including refrigeration. Forecasting systems have been developed for diseases and insect vectors. Effective management of insect and mite vectors of plant pathogenesis is of crucial importance to minimize vector-borne diseases in crops. Pesticides play an important role in managing vector populations by reducing the number of individuals that can acquire and transmit a virus, thereby potentially lowering disease incidence. Certain insecticides exhibit properties other than lethal toxicity that affect feeding behaviours or otherwise interfere with virus transmission. Managing some diseases with fungicides has been challenged by development of resistance, which continues to be difficult to predict. Biocompatible materials such as bicarbonates, milk, oil, silicon, phosphate salts, plant extracts, and biological control agents are being developed as alternatives to conventional fungicides predominantly for powdery mildew. Some of these induce systemic resistance.

### Fungal Diseases

#### 1. Phytophthora Blight

Phytophthora blight is caused by *Phytophthora capsici*. This pathogen can infect all cucurbit crops as well as peppers, tomatoes, eggplants, and infrequently beans. Infection is most common in squash and pumpkin. *Phytophthora capsici* infects every part of the plant including roots, crowns, leaves, vines and fruit.



### Management

- Plant in well drained fields. Used raised beds to improve drainage. Do not work in fields when soils are wet to avoid compacting soil.
- Avoid planting susceptible crops in fields with a history of disease.
- Rotate out of cucurbit and solanaceous crops for a minimum of 3 years.
- Remove and destroy infected fruit and vines in small gardens.
- In large fields, till in a small area of infected plants plus a border of healthy plants. Clean equipment thoroughly afterwards.
- Clean tools after working with Phytophthora infected plants.
- Fungicide sprays can help to prevent disease

### 2. Downy Mildew

Downy Mildew, caused by *Pseudoperonospora cubensis*, is an oomycete that is not a true fungus and is often referred to as a water mold due to the fact that it thrives in wet or very humid conditions. Downy Mildew can infect all cucurbits including cucumber, melon, pumpkin and squash. Although it can be a problem in field, hoop house and greenhouse conditions.



### Management

- Plant resistant varieties when available. Cucumber varieties with moderate to high level of resistance are available, moderate to low levels of resistance is available for melons. Some resistance available in pumpkins and winter squash but this tends to be specific for certain pathotypes of Downy Mildew and may not be effective in all cases.
- Use drip irrigation and wide row spacing to promote leaf drying and encourage good air movement around the plants.
- Monitor plants for symptoms of disease especially from August through harvest.
- If the disease is found in a home garden, plants should be immediately removed and destroyed to prevent the spread to other plants.
- Fungicides are effective if applied before disease becomes severe. Both contact and systemic fungicides are registered for use against downy mildew. Systemics are more effective if weather conditions are conducive to disease and the host is very

susceptible. However using the same systemic fungicide repeatedly can result in fungicide resistance. It is important to rotate systemic fungicides or tank mix with a contact to avoid this.

### 3. Seed Rot and Damping-off

Cucurbit seeds need warm soils to germinate and develop properly (65F at 2" depth). Seeds that are planted in cold, wet soils are at risk of seed rot and damping off. These diseases are caused by several different fungi that live in the soil including *Rhizoctonia*, *Pythium* and *Fusarium*. Damping off fungi infect and rot both seeds and young seedlings. Infected seeds may not emerge from the soil. Seedlings may emerge with soft brown water soaked areas on the cotyledons (seed leaves). Stems may be thin, wire-like and unable to support even the small seedling. Fine cobweb like fungal mycelia may be visible growing on wet potting media and infected seedlings. Infected plants are unlikely to grow into a mature plant.



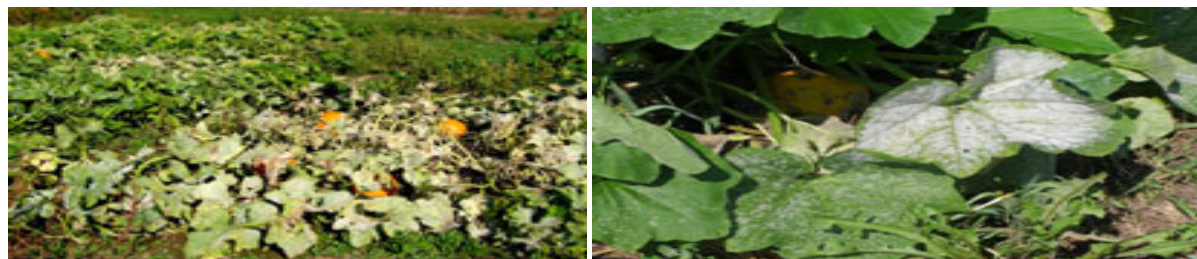
#### Management

Seed rot and damping off can be avoided by following several cultural practices. Do not plant cucurbit seeds outdoors until soils have completely warmed to 65F at a 2" depth. Keep beds moist but not water logged. In areas of Minnesota where the weather will not provide these conditions, pumpkin, squash and some melon seeds can be started indoors.

Seed plants in pots that are at least 2 inches wide and deep. Transplant seedlings once they have 2-3 true leaves and soil temperatures have reached 65F. Take extra care not to disturb the plants root system or damage the plant when transplanting cucurbit seedlings. Some seed companies provide 'treated seed' which is coated with a layer of fungicide that will help to prevent seed rot.

### 4. Powdery Mildew

Powdery mildew, caused primarily by the fungus *Podosphaera xanthii*, infects all cucurbits, including muskmelons, squash, cucumbers, gourds, watermelons, and pumpkins. In severe cases, powdery mildew can cause premature death of leaves, and reduce yield and fruit quality.



#### Management

- Plant varieties with complete or partial resistance to powdery mildew.
- Apply fertilizer based on soil test results. Avoid over applying Nitrogen.



- Provide good air movement around plants through proper spacing, staking of plants and weed control.
- If susceptible varieties are being grown in an area where powdery mildew has resulted in yield loss in the past, fungicide may be necessary.
- Once a week examine 5 mature leaves for powdery mildew infection (in large plantings, repeat at 10 different locations in the field).
- Apply fungicides when a single spot of powdery mildew is first found.

Home gardeners can apply sulfur products to both the upper and lower surface of the leaves.

### 5. Choanephora Rot

Choanephora rot is caused by the fungus *Choanephora cucurbitarum*. The fungus survives from season to season in crop debris and is spread to new flowers by insects, splashing water, or wind. Choanephora Rot, also known as blossom end rot or wet rot, is a disease most commonly found on summer squash under wet conditions. This disease has been seen occasionally on other cucurbits including pumpkin and vegetable marrow.

#### Management

- Fungicides are ineffective against Choanephora rot because new susceptible flowers open every day.
- Rotate out of cucurbits.
- Avoid overhead irrigation
- Space plants to provide adequate air movement in the field to quickly dry flowers and fruit.
- Raised plant beds and plastic mulch may be of help to limit fruit contact with moist soil and reduce moisture in the lower plant canopy.



### 6. Anthracnose

Anthracnose is caused by the fungus, *Colletotrichum orbiculare*. This pathogen can attack all cucurbits but the most severe disease is seen on cucumbers, muskmelons, and watermelons.



#### Management

- Purchase clean seed from a reputable source. Do not save seed from infected plants.
- Some resistant varieties of cucumber are available.
- Rotate vegetables so 3 years go by before planting any member of the squash family in the same location.
- Use drip irrigation instead of overhead sprinklers if possible.
- Do not work in plants when wet.
- Remove and destroy infected vines at the end of the season in small gardens.
- In large fields till under crop residue at the end of the season.

- Several fungicides are registered for use against Anthracnose but may not provide adequate control if good coverage of fruit and leaves is not achieved.

### 7. Scab

Scab is caused by the fungus *Cladosporium cucumerinum*. The fungus infects cucumbers, melons, summer squash, pumpkins, and winter squash. Watermelon is very resistant to the disease and many varieties of cucumber that have resistance to scab are now available.



#### Management

- Purchase clean seed from a reputable source. Do not save seed from infected plants.
- Resistant varieties of cucumber are available and are the best management option for that crop.
- Rotate vegetables so 2 or more years go by before planting any member of the squash family in the same location.
- Use drip irrigation instead of overhead sprinklers if possible.
- Do not work in plants when wet.
- Remove and destroy infected fruit and vines at the end of the season in small gardens.
- In large fields till under crop residue at the end of the season to speed up decomposition.
- Several fungicides are registered for use against Scab. Preventative sprays are effective but are only necessary in fields with a history of scab. Squash sprays should start at bloom. Melon and pumpkin sprays should start when the vines begin to run.

### 8. Gummy stem blight and black rot

Gummy stem blight and black rot are both caused by the fungus *Didymella bryoniae*. Gummy stem blight describes the leaf and stem infection stages of the disease. Black rot describes the fruit rot stage. Fruit rot may develop in the field or after the plant has been harvested.



#### Management

- Buy clean seed from a reputable source. If saving seed, do not collect seed from infected plants.
- Rotate vegetables so 2 or more years go by before planting any member of the squash family in the same location.

- Use drip irrigation instead of overhead sprinklers if possible.
- Remove and destroy infected fruit and vines at the end of the season in small gardens.
- In large fields, till in infected plant debris at the end of the season to speed up decomposition.
- Use powdery mildew resistant varieties or spray to control powdery mildew.
- Use integrated pest management practices to control cucumber beetles and other insect pests.

### 9. *Alternaria* leaf blight

*Alternaria* leaf blight is caused by the fungus *Alternaria cucumerina*. This disease is most problematic on melon but can also occur on cucumber, pumpkin and squash. *Alternaria* leaf blight does not commonly infect fruit but can reduce yield and quality through reduced plant vigor and sunscald of exposed fruit.

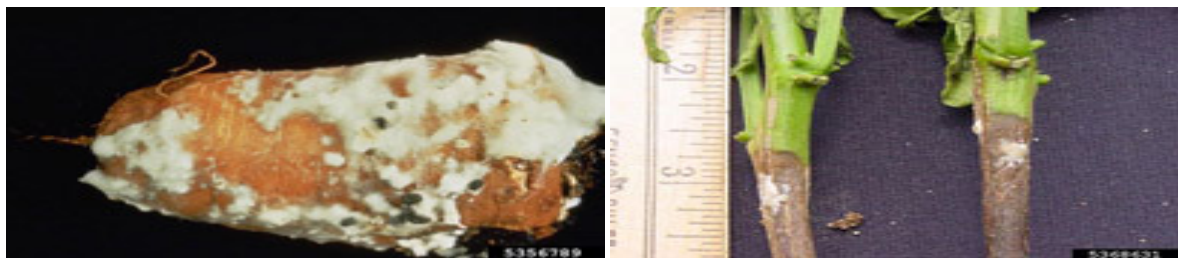


#### Management

- Rotate vegetables so 3 or more years go by before planting any member of the squash family in the same location.
- Use drip irrigation instead of overhead sprinklers if possible.
- Do not work in plants when wet.
- Remove and destroy infected plants at the end of the season in small gardens.
- In large fields till under crop residue at the end of the season.
- Several fungicides are registered for use against *Alternaria* Leaf Blight. Preventative sprays are effective but are only necessary in fields with a history of *Alternaria* Leaf Blight.

### 10. White mold

White mold is caused by the fungus *Sclerotinia sclerotiorum*. This pathogen infects a wide variety of vegetable crops including beans, carrots, tomato, cabbage, and lettuce. In the cucurbit family pumpkins and some varieties of winter squash are most severely affected by the disease. This disease does not cause leaf spots but infects both stems and fruit.



#### Management

- No resistant varieties are available, but plants with an open growth habit have less disease than plants with dense leaf coverage.



- Use wide row spacing, control weeds and plant rows parallel to prevailing wind to promote rapid drying of plant leaves.
- If only a few plants are infected remove them from the field before sclerotia form and bury them deeply.
- Do not compost infected fruit or other plant material.
- Crop rotation to corn or other grasses to limit or reduce pathogen in the soil.

## Bacterial Diseases

### 1. Bacterial Wilt

Bacterial wilt is caused by the bacterium *Erwinia tracheiphila*. This pathogen can cause severe losses in cucumbers and muskmelons; squash and pumpkins are less severely affected. Watermelon is not affected.



## Management

- Managing cucumber beetles provides the most effective control of bacterial wilt.
- If disease appears in a few plants, rogue and bury these plants to prevent further spread of the disease.
- Pesticides will not help in managing a cucurbit plant infected with this bacterial disease.

### 2. Angular leaf spot

Angular leaf spot is a bacterial disease caused by *Pseudomonas syringae* pv. *lachrymans*. Although angular leaf spot can occur on any of the cucurbit crops, cucumber is less commonly affected due to the availability of resistant varieties.



## Management

- Many resistant varieties are available for cucumbers and are the best form of control for this crop.
- Buy clean seed from a reputable source. If saving seed, do not collect seed from infected plants.
- Rotate vegetables so 2 or more years go by before planting any member of the squash family in the same location.
- Use drip irrigation instead of overhead sprinklers if possible.

- Do not work in plants when leaves are wet.
- Remove and destroy infected fruit and vines at the end of the season in small gardens.
- In large fields, till in infected plant debris at the end of the season to speed up decomposition.
- Copper can slow the spread of disease if the infection is caught early. Sprays are not effective once disease is severe. Sprays do not need to be continued if dry weather persists beyond 2 weeks.

### Viruses

These diseases are caused by several different viruses including Cucumber Mosaic Virus (CMV), Squash Mosaic Virus (SqMV), Zucchini Yellow Mosaic Virus (ZYMV), Watermelon Mosaic Virus 2 (WMV-2) and Watermelon Mosaic Virus 1 (WMV-1) also known as Papaya Ringspot Virus (PRSV).

### Identification

It is difficult to distinguish between the different viruses by symptoms alone. Symptoms vary depending on the crop, variety, age of the plant at the time of infection and in some cases weather. In addition it is common to find plants infected with more than one virus at the same time, often resulting in combined severe symptoms.

Virus infected leaves often have a mottling or mosaic pattern in shades of green and yellow. This mosaic can be very distinct and obvious or fairly subtle. Leaves are often distorted or deformed. They may be puckered, cupped under, have deep lobes, or appear thin and string-like. Young leaves often show the most severe symptoms and are frequently abnormally small. Growth on infected vines is typically stunted and in CMV infections, vines may wither completely.

The virus's affect on fruit varies depending on when the plant was infected. Early infections often result in no or very low fruit production. Later infection can result in fruit that is small, deformed and discolored. Fruit may have a mottled or mosaic pattern, ring spots or exhibit color break on all or part of the fruit. Melons infected with SqMV often lack netting at maturity.



### Management

- Plant resistant or tolerant varieties whenever available. Resistance is virus specific and it is necessary to first determine which mosaic virus is causing disease in order to select appropriate viruses.
- Purchase clean seed from a reputable supplier. If saving seeds, do not collect seed from infected plants.
- Control weeds within and around the field. Especially focus control efforts on perennial weeds that may allow the virus to carry over from one season to the next.



- Manage aphids and cucumber beetles to keep populations low.
- If disease appears in a few plants, rogue and bury these plants to prevent further spread of the disease.
- Clean tools and workers hands with soap and water after working with infected plants. Reduce maintenance tasks that require handling of infected plants as much as possible.
- In greenhouse or hoop house production, use screening and other methods to exclude aphids. Eliminate weeds or other virus hosts within 350 feet of the greenhouse or hoop house. Avoid planting cucurbit field crops next to hoop house or greenhouse production areas.
- There are no pesticides that can be applied to reverse or limit the symptoms of viral infection.

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